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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/550,753

09/23/2005

Kunihiko Iwamoto

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05/16/2007

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EXAMINER

CHEN, KEATH T

ART UNIT

PAPER NUMBER

1709

MAIL DATE

DELIVERY MODE

05/16/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/550,753

Applicant(s)

IWAMOTO ET AL.

Examiner

Keath T. Chen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 23 September 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-11 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-11 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 23 September 2005 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date 4/2/2007, 5/22/2006, 9/23/2005.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- ☐ Notice of Informal Patent Application
- ☐ Other: _____.

DETAILED ACTION

Drawings

1. The drawings are objected to because Fig. 14 is not labeled as "prior art".

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

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2. Claims 1-4 and 6-7 are rejected under 35 U.S.C. 102(b) as being anticipated by Moore et al. (US 5683518, hereafter '518).

'518 teaches all limitations of claim 1:

A deposition system (Fig. 3B, #320) which supplies a source gas and a purge gas alternately (col. 10, lines 63-66) for deposition, comprising: a deposition chamber (#303); a substrate holding unit which holds a substrate in the deposition chamber (#304); a source gas supply unit which supplies the source gas to the deposition chamber; a reactive gas supply unit which supplies a reactive gas to the deposition chamber; a purge gas supply unit which supplies the purge gas to the deposition chamber (#314a and #314b, see more discussion below); an exhaust unit which exhausts the source gas, the reactive gas, and the purge gas from the deposition chamber (exhaust lines #309a and #309b; and a vacuum pump, col. 33, lines 7-10 applies to Fig. 3B); a first heating unit (#327) which heats the substrate arranged in the deposition chamber to maintain the same to a predetermined temperature (col. 16, 2nd paragraph); and a second heating unit (#310) which heats the substrate arranged in the deposition chamber rapidly (col. 15, 2nd paragraph, describes #310 in Fig. 3A is capable of quickly heat the wafers. Since #310 in Fig. 3B is the same as #310 in Fig. 3A, see col. 15, 7th paragraph, the heating unit #310 in Fig. 3B is capable of heating the deposition chamber rapidly).

Although only two gas inlets are shown in Fig. 3B, '518 teaches 2-10 gas injection jets can be used (col. 30, lines 47-52), requiring a gas supplying unit associated with each injection jet. Therefore, '518 discloses using 3 gas inlets which

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can input 3 different gases and is capable of supplying a source gas, a reactive gas, and a purge gas.

'518 teaches the additional limitation of claim 2:

The first heating unit (Fig. 3B, #327) and the second heating unit (#310) are opposed to each other with the substrate (#311) interposed therebetween, so that the first heating unit heats the substrate from the backside and the second heating unit heats the substrate from the surface.

'518 teaches the additional limitation of claim 3:

The second heating unit (#310, a radiant heat source, col. 15, 2nd paragraph) is an RTP (Rapid Thermal Processing) unit (Applicant's specification demonstrates that radiant heat sources are RPT units, [0025]).

'518 teaches the additional limitation of claim 4:

The second heating unit (#310, outside the wall #301c) is arranged outside the deposition chamber (#303).

'518 teaches the additional limitation of claim 6:

The substrate holding unit has a moving mechanism (Fig. 2C, #202 which is fairly suggested with any embodiment including Fig. 3B) which moves the substrate in position so that the distance between the substrate and the second heating unit can be adjusted by an operation from outside the deposition chamber without opening the deposition chamber (col. 9, line 66 to col. 10, line 1).

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By adjusting position control #202 during (col. 9, line 67) deposition processing requires the distance adjustment is made outside the deposition chamber without opening the deposition chamber.

'518 teaches the additional limitation of claim 7:

Further comprising an annealing gas introducing unit which introduces an annealing gas into the deposition chamber.

'518 cites annealing as one of the use of the reactor (col. 51, 2nd paragraph and col. 11, 4th paragraph), requiring an annealing gas introducing unit is present.

Furthermore, '518 provides 2-10 gas injection jets (col. 30, lines 47-52) while claim 6 requires 4 gas supply units.

3. Claims 1, 3-4, and 6-8 are rejected under 35 U.S.C. 102(b) as being anticipated by Takagi (US 5445676, hereafter '676).

'676 teaches all limitations of claim 1:

A deposition system (Fig. 7) which supplies a source gas and a purge gas alternately (see discussion below) for deposition, comprising: a deposition chamber (#24); a substrate holding unit which holds a substrate in the deposition chamber (#23); a source gas supply unit which supplies the source gas to the deposition chamber; a reactive gas supply unit which supplies a reactive gas to the deposition chamber; a purge gas supply unit which supplies the purge gas to the deposition chamber (inert gas and reactant gas inlets, see more discussion below); an exhaust unit which exhausts the source gas, the reactive gas, and the purge gas from the deposition chamber (outlet labeled exhausting); a first heating unit which heats the substrate arranged in the

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deposition chamber to maintain the same to a predetermined temperature (#26); and a second heating unit (#22) which heats the substrate arranged in the deposition chamber rapidly.

The second heating unit is set at a higher temperature (col. 12, lines 28-32), therefore, it heats the substrate more rapidly than the first heating unit.

Although only two gas inlets are shown in Fig. 7, '676 teaches that two reactant gases flow through the lower gas inlet (col. 12, lines 57-60), implied two gas supplying units. Together with the gas supply unit associated with the upper gas inlet, these three gas supply units are capable to provide the function of source gas supply, reactive gas supply and purge gas supply to the deposition chamber. These two gas inlets are capable of supplying a source gas and a purge gas alternately.

'676 teaches the additional limitation of claim 3:

The second heating unit (#22) is a RTP (Rapid Thermal Processing) unit.

The second heating unit (#22) is a more rapid heating unit than the first heating unit (#26).

'676 teaches the additional limitation of claim 4:

The second heating unit (#22) is arranged outside the deposition chamber (#24).

'676 teaches the additional limitation of claim 6:

The substrate holding unit has a moving mechanism (Not shown in Fig. 7, shown in Fig. 1, #7-11) which moves the substrate in position so that the distance between the substrate and the second heating unit can be adjusted by an operation from outside the deposition chamber without opening the deposition chamber (col. 11, lines 31-47, to

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carry out growth and annealing at different position requires adjustment of position without opening the deposition chamber).

'676 teaches the additional limitation of claim 7:

Further comprising an annealing gas introducing unit that introduces an annealing gas into the deposition chamber.

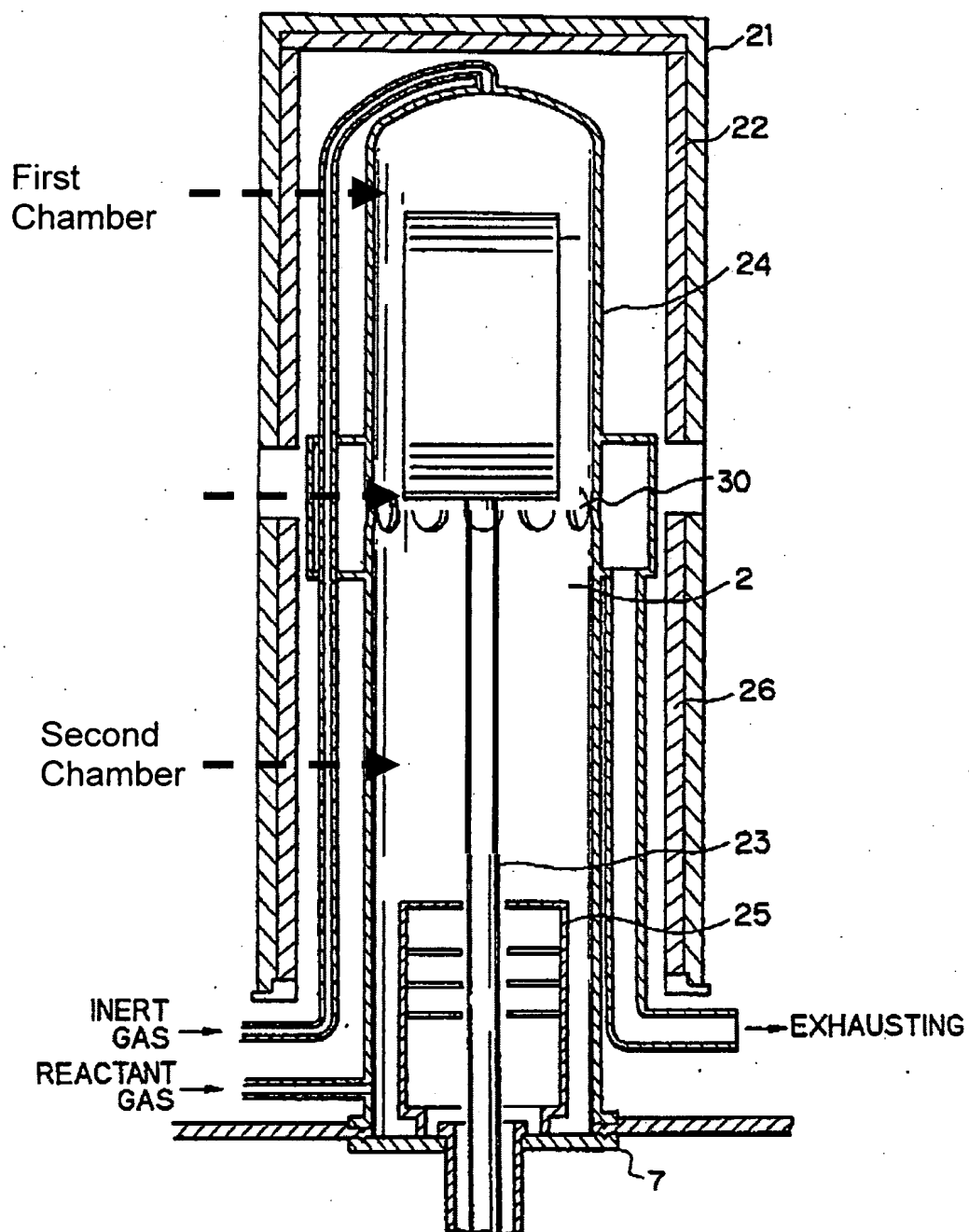
'676 cites rapid thermal annealing as one of the use of the reactor (col. 10, lines 41-44), requiring an annealing gas introducing unit is present.

'676 teaches all the limitation of claim 6, as discussed above. '676 further teaches the additional limitations of claim 8:

An annealing gas introducing unit which introduces an annealing gas into the deposition chamber (discussed in claim 7 rejection above), and wherein when the substrate is put closer to the second heating unit by the moving mechanism, the substrate or the substrate holding unit sections (see discussion below) the deposition chamber into a first chamber (the second region in '676, near heater #24) having the annealing gas introducing unit (the inert gas inlet is capable of supplying annealing gas from top to the second region) and a second chamber (first region in '676, near heater #24, see abstract) having the source gas supply unit and the reactive gas supply unit (the low gas inlet is capable of supply a mixture of reactive gas and source gas, as discussed in claim 1 rejection above) so that the surface of the substrate is exposed to the first chamber (the surface of the substrate is exposed to the first chamber as the two chambers are connected).

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Note that substrate holding unit can be outside the first chamber (or the second chamber) while substrate(s) is/are in the first chamber. Therefore, the substrate holding unit sections the deposition chamber into two chambers.



Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
 2. Ascertaining the differences between the prior art and the claims at issue.
 3. Resolving the level of ordinary skill in the pertinent art.
 4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
4. Claims 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over '518, in view of Ushikoshi et al. (US 5683606, hereafter '606).

'518 teaches all the limitations of claim 1, as discussed above. '518 also teaches the application in CVD (col. 19, lines 2-13).

'518 does not teaches:

The first heating unit is a heater formed on a substrate holding surface of the substrate holding unit.

'606 is an analogous art in the field of CVD (col. 1, lines 6-11), particularly in heating devices. '606 teaches that the heating efficiency of indirect heaters is not good (col. 1, lines 14-21). '606 provides a ceramic heater (Fig. 6, #22) to hold wafer (#4, col.

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11, lines 31-39). Therefore, '606 provides a heater formed on a substrate holding surface of the substrate holding unit.

At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to have adopted the ceramic heater of '606 as part of the substrate holding unit of '518, instead of the indirect heating method using a separate susceptor ('518, Fig. 3B, #302) and heater (#307). The motivation would have been to solve the heating efficiency problem associated with indirect heater ('606, col. 1, lines 14-21). Therefore, it would have been obvious a person of ordinary skill in the art to have combined '606 with '518 to have obtained the invention of claim 5.

5. Claims 9-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over '518 as applied to claim 6 above, and further in view of Suflarto et al. (US 6395092, hereafter '092) and Kusuda (US 20020195437, hereafter '437).

'518 teaches all the limitations of claim 6, as discussed above. '518 further teaches the use of a process computer controls temperature process controls, power control, etc. (therefore, controls the second heating unit among many other components) (col. 50, lines 19-22) and sequence the particular process. The purpose of '518 is to form a silicon oxide layer (col. 11, line 66 to col. 12, line 3).

'518 does not teach the use of the above process computer to include the control the moving mechanism ('518, Fig. 2C, #202).

'092 is an analogous art in the high deposition rate of silicon oxide layer. '092 teaches the integrated control of many subcomponents in processing sequence,

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including the substrate positioning (Fig. 1F, #80, capable to control the desired height of substrate in the chamber, col. 9, lines 10-16) and the heater control (#87).

At the time the invention was made, it would have been obvious to a person of ordinary skill in the art to have integrated the position control component, as provided in '092, in the process computer discussed in '518. The motivation would have been to reduce the hardware cost and reduce the time required to configure the entire system ('518, col. 50, 2nd last paragraph). Therefore, a person of ordinary skill in the art would have known to devise a control unit which controls the operation of the second heating unit ('518, Fig. 3B, #310) and the moving mechanism ('518, Fig. 2C, #202), among other components.

'518 further teaches a short annealing time at high temperature after ion implantation (col. 11, lines 31-42). '518 and '092, together, did not explicitly teach the limitation of claims 9-10:

The control unit being configured to start heating the substrate by using the second heating unit after the substrate is put closer to the second heating unit by the moving mechanism.

'437 is an analogous art in the rapid heat treatment of semiconductor wafer, particularly in carrying out an ion activation ([0005]). '437 specifically points out a problem of blunt profile during annealing even when raising the temperature fast ([0005], lines 3-5) and provides a solution for a fast annealing method. '437 teaches the loading of wafer and turning on the first heater (Fig. 5, heating plate #74, [0069]), raising

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the wafer position in the chamber (Fig. 6, [0070]), then turn on the second heating unit (flash lamp, #69, [0072]).

At the time of the invention was made, it would have been obvious to a person of ordinary skill in the art to have sequenced a processing sequence in the process computer that he had devised to turn on the second heating unit after raising the substrate in the process chamber, in order to achieve the desired temperature profile (such as Fig. 3 in '437). A person of ordinary skill in the art would have known that heating is more effective when the substrate is closer to the heat source. The motivation would have been to achieve short annealing time required by '518 and to avoid a blunt dopant profile in the wafer by the teaching of '437. Therefore, it would have been obvious to have combined '437 with '518 and '092 to have obtained the invention of claim 9 with a reasonable expectation of success.

For claim 10, '518 also provides a capability to introduce an annealing gas, as discussed in claim 7 rejection above. '518 further teaches that the process computer includes the control of gas panel (Fig. 16A, #1601, col. 50, lines 7-10), including the annealing gas line.

For the same motivations as discussed above (to reduce the hardware cost and reduce the time required to configure the entire system), it would have been obvious to a person of ordinary skill in the art to have included the control of moving mechanism in the process computer controlling the second heating unit and the annealing gas introducing unit, and to have sequenced a processing sequence to turn on the second heating unit after raising the substrate in the process chamber (to achieve the desired

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temperature profile), to have obtained the invention of claim 10 with a reasonable expectation of success.

For claim 11, '437, '518, and '092, together, teaches all the limitations of claim 9, as discussed above. '518 further teaches that the process computer includes the control of the exhaust unit (Fig. 16A, col. 49, line 65 to col. 50, line 6).

For the same motivations as discussed above (to reduce the hardware cost and reduce the time required to configure the entire system), further motivation being to make it easier for the computer control of the interrelated gas distribution and scrubbing (col. 50, lines 14-18), it would have been obvious to a person of ordinary skill in the art to have included the control of exhaust system to have obtained the invention of claim 11 with a reasonable expectation of success. (This deposition system is inherently capable of exhaust air from the entire deposition chamber when the substrate is put away (retracted) from the second heating unit by the moving mechanism.)

Conclusion

6. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. US 6306216 is cited for its teachings of reaction chamber sections into two sub-chambers. US 5730801 and US 5245171 are cited for their teachings of reaction chamber sections into two substantially sealed sub-chambers. US 6753506 is cited for its teaching of small volume annealing chamber. US 6077764 and 6156149 are cited for their teachings of process control. US 5280156 is cited for its integrated heater and chuck.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Keath T. Chen whose telephone number is 571-270-1870. The examiner can normally be reached on M-F, 8:30-5:00 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Cleveland can be reached on 571-272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

kc

K.C.


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